

AMENDMENTS TO THE CLAIMS

- 5 Claim 1 (Previously presented) An extrusion-free wet cleaning process for post-etch Cu-dual damascene structures, the process comprising:
- 10 providing a wafer comprising a silicon substrate and at least one post-etch Cu-dual damascene structure, the post-etch Cu-dual damascene structure having a via structure exposing a portion of a Cu wiring line electrically connected with an N⁺ diffusion region of the silicon substrate and a trench structure formed on the via structure;
- 15 executing an oxidation step by applying a diluted H₂O₂ solution to the wafer to slightly oxidize the surface of the exposed Cu wiring line; and
- washing away cupric oxide generated in the oxidation step by means of a cupric oxide cleaning solution containing diluted HF, NH₄F or NH₂OH having a pH of above 7.
- 20 Claim 2 (Original) The process of claim 1 wherein the Cu wiring line electrically connected with an N⁺ diffusion region of the silicon substrate serves as a cathode in the cupric oxide cleaning solution.
- 25 Claim 3 (Original) The process of claim 1 wherein the method of preventing Cu reduction reactions on the Cu wiring line comprises purging inert gas onto the wafer during the application to the wafer of the diluted H₂O₂ solution.
- 30 Claim 4 (Original) The process of claim 1 wherein the method of

preventing Cu reduction reactions on the Cu wiring line comprises adding a Cu corrosion inhibitor to the diluted H_2O_2 solution.

- 5 Claim 5 (Original) The process of claim 4 wherein the Cu corrosion inhibitor comprises benzotriazole (BTA).

10 Claim 6 (Previously presented) The process of claim 1 wherein the method of preventing Cu reduction reactions on the Cu wiring line comprises reducing the H_2O_2 concentration of the diluted H_2O_2 solution to below 100:1 (v/v) of solvent to H_2O_2 .

15 Claim 7 (Original) The process of claim 1 wherein the method of preventing Cu reduction reactions on the Cu wiring line comprises lowering the temperature of the diluted H_2O_2 solution to below $15^\circ C$ during the application to the wafer of the diluted H_2O_2 solution.

20 Claim 8 (Cancelled)

25 Claim 9 (Currently amended) A wet cleaning process comprising:
an oxidation step ~~comprising~~ incorporated with a means for reducing Cu deposition on a cathode-like copper wiring line of a Cu-dual damascene structure, wherein the means for reducing Cu deposition on a cathode-like copper wiring line comprises a step of purging an inert gas during the oxidation process; and
an oxide etch step for washing away cupric oxide generated in the oxidation step by means of a cupric oxide cleaning
30 solution.

5 Claim 10 (Original) The process of claim 9 wherein the oxidation step is used to slightly oxidize a surface of a Cu wiring line in a dual damascene structure by utilizing a diluted H_2O_2 solution.

10 Claim 11 (Original) The process of claim 9 wherein the cupric oxide cleaning solution comprises diluted HF, NH_4F , NH_2OH , or diluted HF/HCl.

15 Claim 12 (Original) The process of claim 9 wherein the oxide generated in the oxidation step comprises Cu_2O and $Cu(OH)_2$.

20 Claim 13 (Original) The process of claim 9 wherein the cathode-like copper wiring line is electrically connected with an N⁺ diffusion region of a silicon substrate.

25 Claim 14 (Cancelled)

30 Claim 15 (Original) The process of claim 9 wherein the process of reducing Cu deposition on a cathode-like copper wiring line comprises adding a Cu corrosion inhibitor to the diluted H_2O_2 solution.

35 Claim 16 (Original) The process of claim 15 wherein the Cu corrosion inhibitor comprises benzotriazole (BTA).

40 Claim 17 (Previously presented) The process of claim 9 wherein the process of reducing Cu deposition on a cathode-like copper wiring line comprises reducing the H_2O_2 concentration of the

diluted H_2O_2 solution to below 100:1 (v/v) of solvent to H_2O_2 .

5 Claim 18 (Original) The process of claim 9 wherein the process of reducing Cu deposition on a cathode-like copper wiring line comprises lowering the temperature of the diluted H_2O_2 solution during the oxidation step to below $15^\circ C$.

10 Claim 19 (Original) The process of claim 9 wherein the process of reducing Cu deposition on a cathode-like copper wiring line comprises increasing the pH of the cupric oxide cleaning solution to above 7.